Similarities and Differences in the Acquisition between L1 and L2 Sounds: with focus on the roles of habitual, innate and natural factors

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要　旨

本論の目的は，第二言語音声習得プロセスの特徴を考察すること，そしてその考察から得られる教育的示唆を示すことである。その目的の為に，本論では次の 2 つのステップを経る。最初に，音声習得の特殊性を確認するため，主に経験的要因と生得的要因に着目しながら，第一言語における音声習得と文法習得のプロセスの違いを明らかにする。次に，筆者が過去に行った研究結果のいくつかを再検証することにより，第一言語音声習得と第二言語音声習得のプロセスの違い，そしてその違いを引き起こすいくつかの要因を明らかにし，結果として上記に示した目的を達する。

I. Introduction: The Transition of the Language Acquisition Theory

It was thought that human and animal behaviour could be studied in terms of the process of habit formation from the standpoint of behaviourism which had flourished until the 1960s. In short, as Ellis (1985) states, behaviourists thought that a habit was formed when a particular stimulus was regularly linked with a particular response, and that the link was reinforced when humans and animals received the response that they expected. This idea was applied to language learning theory, and in First Language Acquisition (FLA), children were thought to have acquired their First Language (L1) by imitating and repeating utterances spoken by adults, especially mothers. For example, a Japanese mother may

repeatedly say "*Mama*" pointing her finger at herself and encouraging her babies to repeat it. When the babies receive this language stimulus, they imitate it as their response, and the link between the stimulus and the response is reinforced when they succeed in producing the word because they are praised by their mother. It was supposed that L1s were acquired by repeating the above process.

However, as it is now widely recognised, this assumption left out of account many aspects of FLA. For example, Okita (2000) outlined the following examples as typical errors made by young children: "*Mommy sock. No the sun shining. What the dollie have*," but these errors should not be made if they acquire their L1s only by repeating their mothers' words, because mothers do not make such errors. A number of problems like this were outlined, and they led to the widespread notion that human-beings have the innate ability to acquire language. To discuss these problems in depth is beyond the scope of this paper, so we will outline the poverty of the stimulus argument as the typical example; that is, the language competence of native speakers of a language is far beyond the input they have received in samples of speech heard since birth. For instance, according to Cook (1985), native speakers of English succeed in acquiring the differences between the following two sentences, which seem to have the same structure but which have different underlying structure, at about seven years of age: 1. John is eager to please (John is pleasing other people).; 2. John is easy to please (Other people are pleasing John). He claims that native speakers cannot acquire this kind of knowledge by relying upon positive evidence that they have heard because the surface structures are the same. Even if it was possible that such differences were explained by adults, such accidental occurrences would not explain why children acquire the differences at about the same age. Therefore, it is possible to say that this kind of universal knowledge comes from the innate property of human-beings. This is a logical and basic problem which was proposed by the cognitive approach triggered by Chomsky proposing his theory of *Universal Grammar* and *Language Acquisition Device*. These innate faculties are supposed to be activated after human-beings receive inputs and thus enable them to equally acquire more complex rules and structures in a fixed order in FLA.

As summarised above, the notion that human-beings have the innate ability to acquire language and consequently show universal developmental phenomena in the acquisition process has occupied a firm position in FLA. However, since the frame of the above theory mostly relied on syntactic and morpheme studies, we cannot say the above assumption totally applies to the acquisition of pronunciation, to which little attention has been given. Therefore, the first aim of this paper is observing universal developments in the acquisition process of L1 sounds and examining whether innate faculties also play a main role in the acquisition. Based on these arguments, we will clarify how human-beings, especially babies and young children, acquire L1 sounds.

II. The Acquisition of L1 Sounds

The possibility of universality in the acquisition process of L1 sounds might be mostly dependent on the intrinsic difficulty of the sounds. For example, the English sounds [r] and [θ] are said to be intrinsically difficult sounds because they require more complicated tongue control, so it is commonly observed that English children can only acquire these sounds at a very late stage. Another factor which contributes to universality is the notion of *markedness*. Markedness is mainly approached from the perspective of language typology. Features which are simple and common in human language are said to be unmarked. On the other hand, features which are complex and less common are said to be marked. In language acquisition, unmarked features are generally acquired earlier than marked features, mainly because marked features require more precision in using the tongue muscles. Therefore, the degrees of the intrinsic difficulty and markedness are often in total accord. For example, it is said that English children pass through a five vowel stage (usually [a, i, u, e, o]), before acquiring the correct articulation of the English [æ]. This claim implicates the English [æ] as a more intrinsically difficult and marked sound than the other vowels. Based on this kind of findings, past studies (e.g., Ito, 1990) give clear evidence that the common acquisition order of L1 sounds can be observed.

Concerning the universality in the development of L1 sounds, the following experiment by Masataka (1991) suggests that the developmental process of acquiring sounds could be innately scheduled in a certain aspect. In this study, he highlighted the fact that the fundamental frequency of a premature baby's cry is usually higher than that of a baby who is born on the expected date of confinement, and investigated how the sound of the former's cry developed comparing it with that of the latter's. The following three groups were enrolled in his experiment: 3 premature male babies who were born 45 days (± 5 days) earlier than the expected date of confinement; 10 male babies who were born on the expected date of confinement (± 2 days) and had average weight (M: 3122 gm); 10 male babies who were born on the expected date of confinement (± 2 days), but their weight was lighter than the average weight (M: 2230 gm)[1]. Voice recordings were conducted for the first group on their birthdays (meaning 235 days after fertilization), 45 days later (280 days after fertilization), and 90 days later (325 days after fertilization). For the second and third groups, the recording was done on their birthdays (meaning 280 days after fertilization) and 45 days later (325 days after fertilization). He measured the fundamental frequencies of their cry sounds after removing the data of discontinued features of the fundamental frequencies.

Concerning the fundamental frequencies of their cry sounds which were recorded 280 days after fertilization, it was reported that no significant difference was found between the

first and the second groups, although the fundamental frequencies of the first group's cry sounds which were recorded on their birthdays (235 days after fertilization) were higher than those. The difference in the language circumstance between them was that the first group was born 45 days earlier than the second group, so they had the opportunity to have contact with their mothers; on the other hand, the second group was just born and they did not have any such experience. Judging from the above, as far as a particular aspect in the acquisition of sounds is concerned, we see the developmental process of a baby's sounds is not conditioned by a learner's experience and environment, but controlled according to the schedule of the development of articulators, which is innately planned.

However, what is interesting in Masataka's experiment (1991) is that he clarified how the development of the articulatory ability to produce proper sounds could depend on the babies' experience of having contact with their mothers. He investigated the probability of the appearance of the data of discontinued features of the fundamental frequencies in each group, which had been removed in the previous analysis. Producing such sounds means failing in articulating sounds, so the lower probability of the appearance in their data indicates that they are better at articulating sounds.

As a result of examining the data which was obtained 280 days after fertilization, it was clarified that the probability of the appearance in the first group was lower than that in the other two groups, which suggests that their experience of having contact with their mothers for about 45 days enabled them to improve their articulatory ability to produce proper sounds. What is more, all of the three groups succeeded in lowering the probability of the appearance at the same rate when the data was examined setting on the basis of their birthday (meaning, on the day when they started to contact their mothers). This finding suggests that the more contact babies have, the better articulatory ability they acquire. The subject of the research was limited to a baby's cry sounds, but the findings might shed light on the process of acquiring L1 sounds.

The evidence that the acquisition of L1 sounds is significantly dependent on learners' experience to exchange sounds with their mothers can also be seen at a later stage of development. It is generally agreed that babies pass through the following 4 stages until they produce language sounds.

Table 1: The development of L1 sounds produced by babies

	Period	*Examples of Production*
Stage 1	Just born	cry sound, a belch
Stage 2	6 ~ 8 weeks after birth	"*Coo*" sound
Stage 3	6 ~ 8 months after birth	"*Ah*", "*Uh*"
Stage 4	10 ~ 12 months after birth	"*Mama*", "*Papa*"

Stage 1 is the period in which all the sounds they produce are caused by a physiological function. At Stage 2, they intend to produce sounds, but cannot do it properly due to their undeveloped articulators. They become able to produce language sounds, more specifically "vowels", at Stage 3, and finally produce Consonant-Vowel (CV) syllables at Stage 4.

Mothers often repeat the sounds their babies produce like a parrot, and Masataka (1993) reported that babies become able to notice what their mothers are doing and reply to them with similar sounds at about 4 or 5 months after birth. It is an important fact to stress that babies become able to produce language sounds a few months after the above relationship of [stimulus] and [response] is formed. In addition, as Masataka (1993) clarifies in another piece of research, mothers tend to reply to their babies often when the babies succeed in producing language sounds, and one can safely state that this tendency plays a role in reinforcing the response.

Interestingly enough, there is evidence that the "innate ability", which plays the leading role in the acquisition of L1 grammar and morphemes instead of "habit formation", takes the role to make the above exchange of [stimulus] and [response] between babies and mothers work smoothly in the acquisition of L1 sounds. This evidence was brought by Masataka (2001), who showed that human-beings innately prefer concord to discord. He had newborn babies who were born to deaf couples listen to the above two kinds of sounds, and measured how long they were interested in each of the sounds by head-turn preference procedure. The point is that, since they were newborn babies who were born to deaf couples, the "experimental" factors which could affect their preference were excluded in the research. As a result, he found that they paid longer attention to concord, and concluded human-beings innately prefer concord. Since human voice is also concord, the innate feature helps babies build the [Stimulus]-[Response] relationship with their mothers smoothly. To put it briefly, new born babies especially pay attention to their mothers' voice among various sounds in the world to receive sufficient stimulus, and they can do so without any experience thanks to the above innate ability.

As discussed above, as far as the acquisition of L1 sounds is concerned, the evidence which has been outlined so far suggests that the development of the articulatory ability to produce L1 sounds mostly relies on learners' experience of exchanging L1 sounds with adults, especially mothers, and innate abilities do not play a central role, but a supporting role which enables babies to acquire L1 sounds effectively.

Needless to say, the acquisition process of L1 sounds is not completed only by repeating utterances produced by mothers, because, as previously noted, a purely physical limitation prevents young children from producing proper sounds of intrinsically difficult sounds at a certain stage of the acquisition and this phenomenon is observed as a fixed acquisition order. When they face the difficulties, they have to adopt strategies or invent their own rules

to ease the burden of producing difficult sounds to a manageable level. Interestingly, it is reported that some common features can be seen in these strategies. For example, Foster-Cohen (1999) notes that the preference of CV syllable (such as "dog" /dog/ → /do/) is a universal feature in canonical babbling produced by babies under 12 months old. Oller (1974, in Tarone, 1978) also claims that simplifying a difficult sound is the usual strategy of children under 3 years of age (e.g., (a) cluster reduction: blue ⇒ bue; (b) final consonant deletion: big ⇒ bi; (c) weak syllable deletion: banana ⇒ nana). In a later section, we will examine whether similar strategies are also adopted by Second Language (L2) learners in the acquisition of L2 sounds, with the aim of considering similarities and differences between the acquisition of L1 sounds and that of L2 sounds.

III. The Framework for the Acquisition Model of L2 Sounds

As previously noted, the idea that human-beings have innate abilities to acquire language has occupied a firm position in the acquisition of L1 grammar. In the case of Second Language Acquisition (SLA), some researchers tried to apply the above idea to the acquisition of L2 grammar and found some pieces of evidence. For example, Cook (1973, cited in Cook, 1985) found that L2 learners were able to distinguish between the difference in the two structures: *John is eager to please*; and *John is easy to please*, which were previously mentioned. Cook and Newson (1996) outlined some alternative possibilities which could account for how L2 learners acquire such knowledge without using innate abilities, for example, "imitation", "explanation", and "correction and approval", but they explained these possibilities were not sufficient to explain this kind of phenomenon. On the other hand, objections have also been raised against the idea supporting the accessibility to the innate ability in SLA, because there is a fairly general agreement that many L2 learners cannot attain the final stage that is judged as being close to native speakers. This phenomenon is especially conspicuous in the acquisition of L2 sounds, so the accessibility to the innate ability has seldom been the central issue in it. Instead, the research interest which has received attention is the approximation process from L1 sound systems to L2 sounds systems. Selinker (1972) named the linguistic systems that lie midway between a learner's L1 and the L2, *interlanguage*, and the term *interlanguage phonology* has been used to refer to the concept which focuses on the process in which L2 learners gradually approximate their sound systems to the norm of L2 sounds systems.

The nature of the continuum of interlanguage phonology has been clarified by some pieces of research (e.g., Flege, 1980; Major, 1987)[2], and it can be regarded as a continuum in which some of the learner's L1 sounds are gradually replaced by the L2 sounds, as the learning stage progresses. The important point to note is there are some sounds which are

easily replaced, while other sounds are not. In other words, as noted in Isono (2005), the continuum of interlanguage phonology is the selection process that decides which L1 features are transferred and which are not, and also which L2 features are taken into the systems of interlanguage phonology. The selection decision is made by various factors, and the intrinsic difficulty and the markedness of the target sounds could be involved in them. In the next section, we will see how these factors affect the selection process by reexamining the results of the current author's past research, and we will clarify some aspects of the acquisition process of L2 sounds.

IV. The Characteristics in the Acquisition Process of L2 Sounds

There are various factors affecting the decision of the above selection process, but this paper focuses on the following two factors. One is the intrinsic difficulty and markedness of L2 sounds. As mentioned earlier, intrinsically difficult sounds require more complicated tongue control, so they are acquired at a later stage in FLA. It is possible to assume that these sounds are not taken into the system of interlanguage phonology until a later stage of the acquisition because of the difficulty, and consequently the acquisition order of L2 sounds is similar to that of these sounds by native children. For example, Wode (1976), who investigated German learners of English and English learners of German, reported that although some phonological elements were strongly affected by their L1s, some other phonological elements seemed to be acquired in the same way that a child would acquire them in the L1. Johansson (1973) also reported that the higher vowels in Swedish were difficult for all L2 learners, and they were hardly acquired at a beginning stage of learning. The other is Flege's (1987) speech learning model which hypothesizes that a certain phonetic distance is required between L2 sounds and the corresponding L1 sounds to enable L2 learners to construct new phonetic categories. To sum up, it is predicted that the larger the phonetic difference between L2 sounds and the corresponding L1 sounds, the earlier the accurate L2 sounds are acquired, because these L2 sounds are easily recognised as new sounds, and L2 learners notice that the corresponding L1 sounds should not be transferred into their interlanguage.

We focus on the acquisition process of the English [æ] by Japanese learners to examine how the above two factors affect decisions in the selection process in interlanguage phonology. The reason why the English [æ] is examined is that it is a more marked and intrinsically difficult vowel than other English vowels, and the phonetic distance between it and the corresponding Japanese vowel [a] is large compared with the phonetic distance between other English vowels and the corresponding Japanese vowels (See details in Isono, 2003). If other English vowels are acquired earlier than the English [æ] by Japanese

learners, it can be assumed that the effect of intrinsic difficulty on the selection process is stronger than that of the phonetic distance, and the acquisition order of English sounds by Japanese learners could be similar to that by native children. On the other hand, if the English [æ] is acquired earlier than other English vowels by Japanese learners, the phonetic distance between L2 sounds and the corresponding L1 sounds can be assumed to be the primary factor for the decision of the selection process. In this case, the similarity of acquisition process between FLA and SLA is not emphasised, but the common acquisition order of English sounds by Japanese learners could be observed. Isono (2000a, 2003) investigated the acquisition process of the English vowels [ʌ, æ, ɪ, iː, ɛ] produced by 51 Japanese learners and 8 native speakers of English. As a result of acoustic analysis, he found that only the English [æ] was approximated to the native speakers' production as the Japanese subjects became more advanced learners. This result might suggest that the second assumption is correct, and the Japanese [a] is replaced by the English [æ] earlier than other Japanese vowels because of the large phonetic distance between them.

A similar tendency was observed in Isono (2000c) which investigated the acquisition order of the English plosives [p, t, k] in word-initial position, produced by 24 Japanese learners of English and 8 native speakers of English. It is said that a velar plosive [k] is the most intrinsically difficult plosive to produce. In addition, the alveolar plosive [t] is more difficult to produce than the bilabial plosive [p]. In fact, the bilabial plosive [p] begins to be produced at about 10 months after birth (See details in Table 1), but the other two plosives can only be produced at a later stage. On the other hand, as far as Voice Onset Time (VOT) values are concerned, the largest phonetic distance is observed in the pair of the English [t] and the Japanese [t], then the second largest is in the pair of the English [k] and the Japanese [k], and the smallest distance is in the pair of the English [p] and the Japanese [p] (See details in Isono, 2000c). As a result of acoustic analysis, it was discovered that the VOT values for the English [t] and [k] showed significantly more approximation to the native speakers' production than the VOT for the English [p], as the Japanese subjects became more advanced learners.

However, despite the above findings, it is true that there are some features which are difficult to produce regardless of phonetic distances and learners' L1s, such as English plosives in word-final position. As previously mentioned, English children often adopt strategies, such as final consonant deletion : big ⇒ bi, to manage the burden of producing difficult sounds in the acquisition process of L1 sounds. L2 learners also often adopt strategies to reduce the burden in the above selection process, and some researchers try to emphasize the universality of interlanguage phonology by focusing their attention on a strategy which is commonly observed in both FLA and SLA. For example, devoicing word-final voiced plosives in word-final position is said to be a general process in both FLA by

English children (e.g., Edwards & Shriberg, 1983; Smith & Stoel-Gammon, 1983) and SLA[3]. To put SLA more concretely, this rule known as Terminal Devoicing is demonstrated not only by German, Polish, and Russian learners of English whose L1s have the same rule, but also by learners of English whose L1s do not have such a devoicing process (e.g., Altenberg & Vago, 1983; Flege & Davidian, 1984; Major, 1987; Edge, 1991). However, according to Isono (2004) who investigated the English plosives [p, t, k, b, d, g] in word-final position produced by 30 Japanese learners of English and 8 native speakers of English, the strategy adopted by them might vary according to the learners' learning proficiency. In short, the occurrence of devoicing overwhelmed that of epenthesis in the data of learners at the beginners' stage, but the difference became smaller as their learning stage progressed due to significant decrease of the occurrence of devoicing and deletion. Consequently, it was concluded that the strategy of final plosive devoicing is especially preferred by beginners, while both devoicing and epenthesis characterize the productions of advanced learners. This finding questioned the validity of past studies which had sought universal tendency in interlanguage phonology by specifying a particular strategy for all L2 learners, and asserted that it should be considered to change according to L2 learners' learning levels. Judging from the above discussion, we can see some features particular to the acquisition of L2 sounds, which are not observed in the acquisition of L1 sounds, and consequently clarify some differences between them.

V. Conclusion

This paper firstly examined similarities and differences between the acquisition of L1 sounds and that of L1 grammar. One similar point is that a fixed acquisition order could also be observed in the acquisition of L1 sounds, because intrinsic difficulties of L1 sounds and the development of articulators may affect the acquisition process of L1 sounds. In addition, it was noted, as another similar point, that learners adopt strategies or invent their own rules in the acquisition of both L1 sounds and L1 grammar. However, the acquisition of L1 sounds is different from that of L1 grammar in the respect that the former relies on learners' experience of exchanging sounds with adults, especially mothers, but innate abilities play significant roles in the latter.

Next, based on the assumption that a learner's experience is a major factor in the acquisition of L1 and L2 sounds, we considered similarities between them. One approach was to focus on the universality in the acquisition process. However, based on the results of the current author's past research, it has been clarified that although FLA is purely affected by intrinsic difficulty of L1 sounds, the same thing cannot be necessarily said about SLA because marked sounds are often acquired before unmarked sounds as a result of the effect

of phonetic distances. The other approach was to emphasise similar strategies which could be observed in both FLA and SLA. Nevertheless, this assumption was also denied in this paper, because strategies adopted by L2 learners could vary according to their learning levels, and consequently it might be pointless to specify one particular strategy for L2 learners.

As discussed in this paper, the acquisition process of L2 sounds is different from that of L1 sounds in some particular points. Especially, as far as the acquisition process of English sounds by Japanese learners is concerned, the fact that the effect of phonetic distance is often more significant than that of the intrinsic difficulty of the target sounds is pedagogically important, because it enables us to provide a desirable acquisition order of English sounds for them[4].

Notes

1. The reason why he enrolled the third group in his research was to exclude the possibility that differences in the result would be caused by the difference of the babies' weight. As a result, he found the difference did not affect the result because no significant difference was observed between the second and the third group. Therefore, hereafter, this paper focuses on the differences in the production between the first and the second group.
2. These pieces of research mainly reported the following two points: One is that L1 interference is dominant in L2 sound errors, especially at the beginning stage; the other is that the features of L1 interference are replaced by near-L2 features or developmental errors, which involve the same sort of deviations that children usually make in their FLA, step by step after a certain period of learning.
3. On the other hand, Tarone (1978: 24) asserts that "the simple open CV syllable may be a universal articulatory and perceptual unit such that the articulators tend to operate in basic CV programs in all learners", and noted that epenthesis (big ⇒ bigu) might be the common strategy adopted by L2 learners.
4. In the case of the acquisition of English vowels by Japanese learners, Isono (2000b) suggests the vowel duration time is acquired earlier than the vowel sound quality, and Isono (2000a) notes the possibility that the feature of "frontness-backness" of a vowel is acquired earlier than that of "vowel height". These findings suggest that not only phonetic distances between L1 sounds and the corresponding L2 sounds, but also the acquisition order of the above features should be taken into account when L2 sounds are taught to L2 learners.

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